CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-31

April 11, 1977

1. Name of fault: Mission Ridge-Arroyo Parida fault (Santa Barbara County).

2. Location of fault: (See figure 1). Located in Santa Barbara County on the Santa Barbara, Carpinteria, and White Ledge Peak quadrangles. The eastern extension of this fault is discussed in FER-26 by T.C. Smith (1977).

3. Reason for evaluation: This fault lies in the 1976 study area of the 10-year program for fault evaluation in the state (see SP 42, 1977 edition, page 6). Also, [this] fault ~~is~~ classified as potentially active by Santa Barbara County in their seismic safety element (Moore and Taber, 1974).

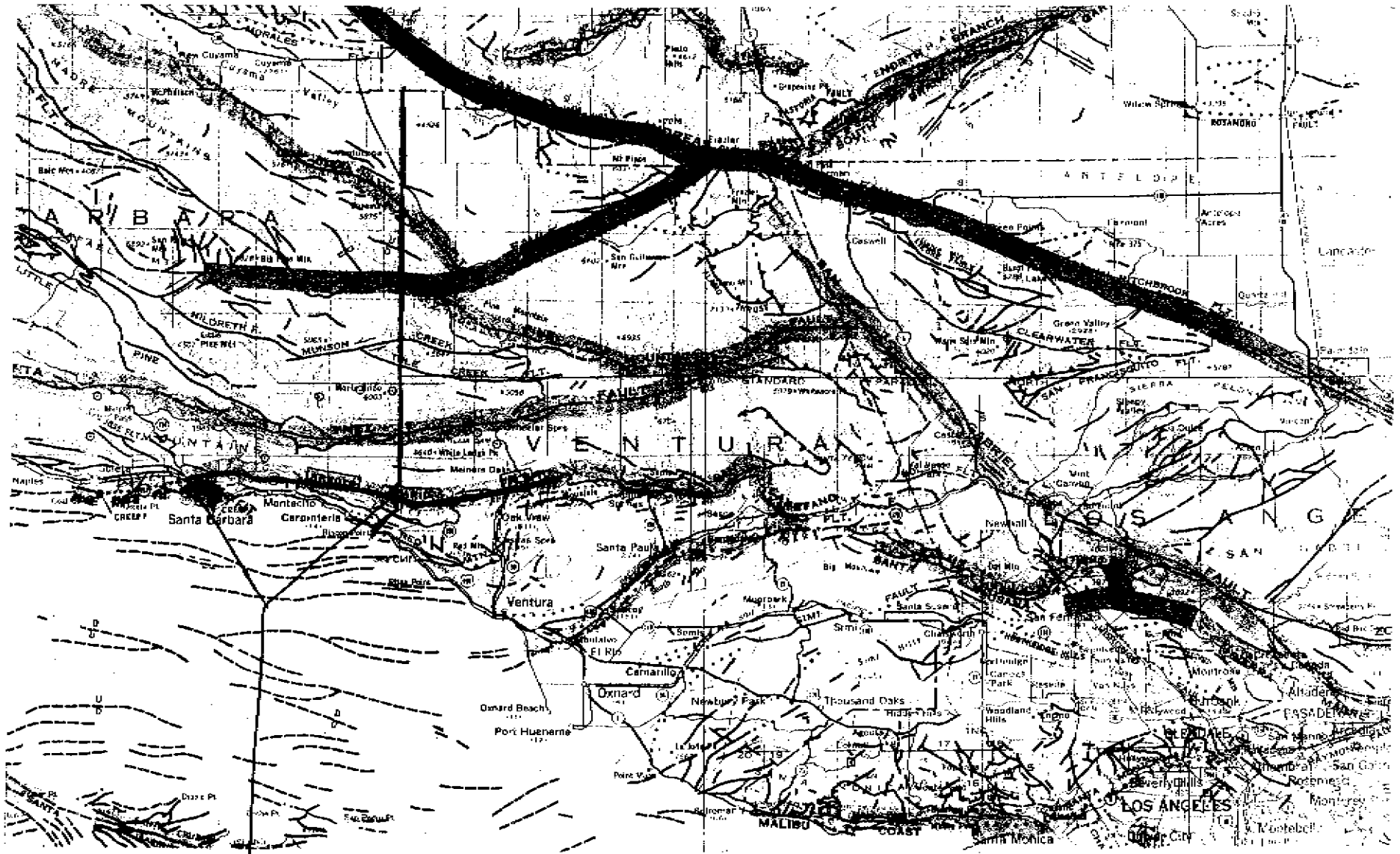
4. List of references:

a) Dibblee, T.W., 1966, Geology of the central Santa Ynez Mountains: California Division of Mines and Geology, Bulletin 186, 99 p., plate 1 (scale 1:31,680).

b) Chauvel, J.P., 1958, Geology of the Arroyo-Parida fault, Santa Barbara and Ventura Counties: University of California at Los Angeles master's thesis, 62 p., plate 1 (scale 1:24,000).

c) Smith, T.C., 1977, The Arroyo Parida fault and Santa Ana fault in Ventura County, California Division of Mines and Geology, Fault Evaluation Report, FER-26 (unpublished file report).

d) Moore and Taber, 1974, Santa Barbara County comprehensive plan -- seismic safety element, 93 p.



AREA COVERED IN This study

County line

Mission Ridge - Arroyo Parida fault

Fig. 1

From Jennings (1975)

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e) Geotechnical Consultants, 1974, Hydrogeologic investigation, Montecito ground water basins, for Montecito Water District, 64 p., plate 3 (scale 1:24,000).

f) Ziony, J.I., et al., 1974, Preliminary map showing recency of faulting in southern California: U.S. Geological Survey Map MF-585, scale 1:250,000.

g) Jennings, C.W., 1975, Fault map of California: California Division of Mines and Geology, California Geologic Data Map Series, Map no. 1, scale 1:750,000.

h) Lian, H.M., 1952, The geology and paleontology of the Carpenteria district, Santa Barbara County, California: University of California at Los Angeles master's thesis, 178 p., plate 1 (scale 1:12,000).

i) Muir, K.S., 1968, Ground water reconnaissance of the Santa Barbara-Montecito area, Santa Barbara County, California: U.S. Geological Survey Water Supply Paper 1859-A, 28 p., plate 1 (scale 1:24,000).

j) NASA, U-2, false color IR photographs: Flight number 73-194, roll 01541, frames 6519-6521.

k) Dibblee, T.W., 1977, Personal communication of March 15, 1977.

5. Summary of available data:

The Mission Ridge-Arroyo Parida fault extends about 35 miles from its intersection with the Mesa and More Ranch faults on the west to the San Cayetano fault on the east (see figure 1). Only that portion of the fault lying within Santa Barbara County is described here.

The Mission Ridge-Arroyo Parida fault, described in this report,

has been described as the Mission Ridge fault west of Montecito (Dibblee, 1966; Muir, 1968) and the Arroyo Parida fault to the east (Lian, 1952; Chauvel, 1958). The fault traces mapped by the principal workers are plotted on plates 1A, 1B, and 1C.

Dibblee mapped the Mission Ridge fault and shows it to be a vertical, dip-slip fault with the south side up. He shows the fault as concealed along most of its trace but locally portrays it as inferred or well located. His evidence for faulting is based on an assumed offset of a Pleistocene fanglomerate (Qfg). This unit lies at a comparatively higher elevation on the crests of "Mission Ridge" and the hill east of Sycamore Canyon (plate 1A) south of the fault. Actually, Dibblee does not show the Qfg to be offset vertically on cross-section E-E' and only about 300 feet of offset is shown on his cross-section F-F'. He indicates the maximum vertical offset of the lower Miocene sediments to be 1500 feet. Dibblee shows the Qfg to be in fault contact with younger alluvial deposits at the western end of the fault. However, he states (personal communication, March 15, 1977) "The younger alluvium is probably depositional against the Qfg. No evidence of faulting was seen in the younger alluvium."

The western portion of the Mission Ridge fault is obscured by alluvium. Dibblee and Muir both show the fault continuing westward as the More Ranch fault (see figure 1). Dibblee noted that the Mission Ridge fault is aligned with the Arroyo Parida fault to the east but that the connection, if it exists, lies buried beneath the Montecito plain. Evidence of a ground water barrier in the Montecito plain indicates that these two faults connect at depth (Muir, 1968; Geotechnical Consultants, 1974). However, the youngest units shown by Muir to be an effective

ground water barrier are early Pleistocene in age.

Chauvel describes the Arroyo Parida fault as steeply dipping to the north with the south side up relative to the north. However, he states that the principal movement along this fault is left-slip with a dip-slip component. The fault is best defined east of Toro Canyon (see plate 1B), where south-dipping beds of the Coldwater Sandstone (Eocene) are faulted against north-dipping beds of the Sespe Formation (Oligocene). Chauvel says that the best evidence for left-slip along the Arroyo Parida fault is the fact that many streams exhibit left-lateral offset where they cross the trace of the fault. However, many streams that cross the fault show no offset at all. Dibblee (plate 2) shows 1500' of vertical displacement in the area of Toro Canyon. Chauvel suggests 2700' of vertical displacement and estimates a greater component of horizontal displacement. Lian found no evidence at all of horizontal displacement in the fault segment he mapped.

No evidence for Holocene movement along the Arroyo Parida fault has been found. In fact, Chauvel indicates there may be some surface evidence for lack of Holocene movement.

First he says that the fault-related topography was not very obvious other than the fact that the fault occupied several topographic lows. He says (p. 52) he did not encounter any fault-line scarps along the Arroyo Parida fault. He also stated (p. 44) that the fact that some streams show left-lateral offset in the vicinity of the fault and others do not may be evidence for a lack of Holocene movement. Of course the offset streams would have to be older than the non-offset streams for this to be true.

6. Interpretation of air photos:

The Arroyo Parida fault shows up on U-2 photos as a weakly defined topographic low except in areas covered by alluvium where no photo lineations could be seen. The Mission Ridge fault did not show any obvious features which could be detected on these photos.

7. Field observations:

The only possible evidence for Holocene activity on the Mission Ridge-Arroyo Parida fault was shown by Dibblee. He mapped the contact between Pleistocene famglomerate (Qfg) and Holocene alluvium as a fault (see plate 1A).

As stated in section five of this report, Dibblee did not indicate the younger alluvium to be faulted, but shown as depositional against the Qfg. Nevertheless, the area was checked at locality 1 and no evidence of faulting was seen either in the Qfg or the younger alluvium. He also described the alignment of north facing escarpments in Qfg at three localities. These localities are shown on plate 1A (see numbers 1, 2, 3). These escarpments are still visible but no evidence of faulting could be found at any of these localities.

8. Conclusions:

The Mission Ridge and Arroyo Parida faults have been shown to connect in the subsurface (Muir, 1968). The sense of movement is not well documented, however, dip-slip movement seems to be demonstrated, at least in the subsurface. Left-slip movement is postulated for the Arroyo Parida segment of the fault but cannot be unequivocally proven, [redacted].

No evidence of Holocene activity is shown along the Mission Ridge-Arroyo Parida fault. Chauvel, in fact, may have evidence for the lack of Holocene movement (see section 5 in this report).

9. Recommendations:

I recommend that the Mission Ridge-Arroyo Parida fault should not be zoned for special studies at this time.

10. Investigating geologist's name; date:

Edward J Bortugno

EDWARD J. BORTUGNO
Geologist
April 11, 1977

D. concur with recommendations
Elliot
4/13/77